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Ground based remote sensing systems for the assessment of cloud amount and cloud properties and comparisons with satellite data during the TUC campaign

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From November 2003 to February 2004 the international TUC (Temperature, hUmidity, Clouds) measurement campaign took place at the aerological station in Payerne, Switzerland. Several active (ceilometer, cloud radar) and passive (microwave and infrared radiometers) ground based remote sensing instruments produced profile measurements as well as height integrated atmospheric quantities. Radiosonde ascents provided reference atmospheric profiles at least twice a day. In addition, Meteosat 2nd generation data were available with a temporal resolution of 15 minutes. One goal of the campaign was the detection of cloud systems, with special focus on fog and low cloud formation, evolution and dissipation.

We analysed TUC data sets with respect to infrared and microwave radiative properties of cloud type as well as their microphysical properties such as integrated water vapor, cloud base temperature, effective radius and opacity at several wavelengths. For the first time, we incorporated a newly developed 151 GHz Radiometer into our analysis. This instrument was mounted on ASMUWARA (All Sky Multi Wavelength RAdiometer) [1]. Because of the sensitivity of this instrument to cloud liquid water, an improved algorithm for the retrieval of integrated liquid water could be applied. Further on, we investigated the possibility of a retrieval of the cloud base height from the combination of a microwave radiometer derived temperature profile and the infrared temperature of the cloud. The results of this solely passive retrieval are compared

with ceilometer measurements. Ongoing research is concerned with the derivation of cloud droplet size distributions with passive microwave measurements at different frequencies. The results of these measurements will be compared with the effective radii retrieved from Meteosat 2nd generation data. Cloud amount is measured with an infrared radiometer that is also mounted on ASMUWARA. Therefore, it can produce hemispheric sky scans every 15 minutes. These measurements are compared to those made by APCADA (Automatic Partial Cloud Amount Detection Algorithm) [2], which uses measurements of the downward longwave radiation in order to estimate cloud coverage.

References

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